6 MAY 1959

GAS IN INDUSTRY

*Supplement to the* "GAS JOURNAL"

Vol. 2 No. 13


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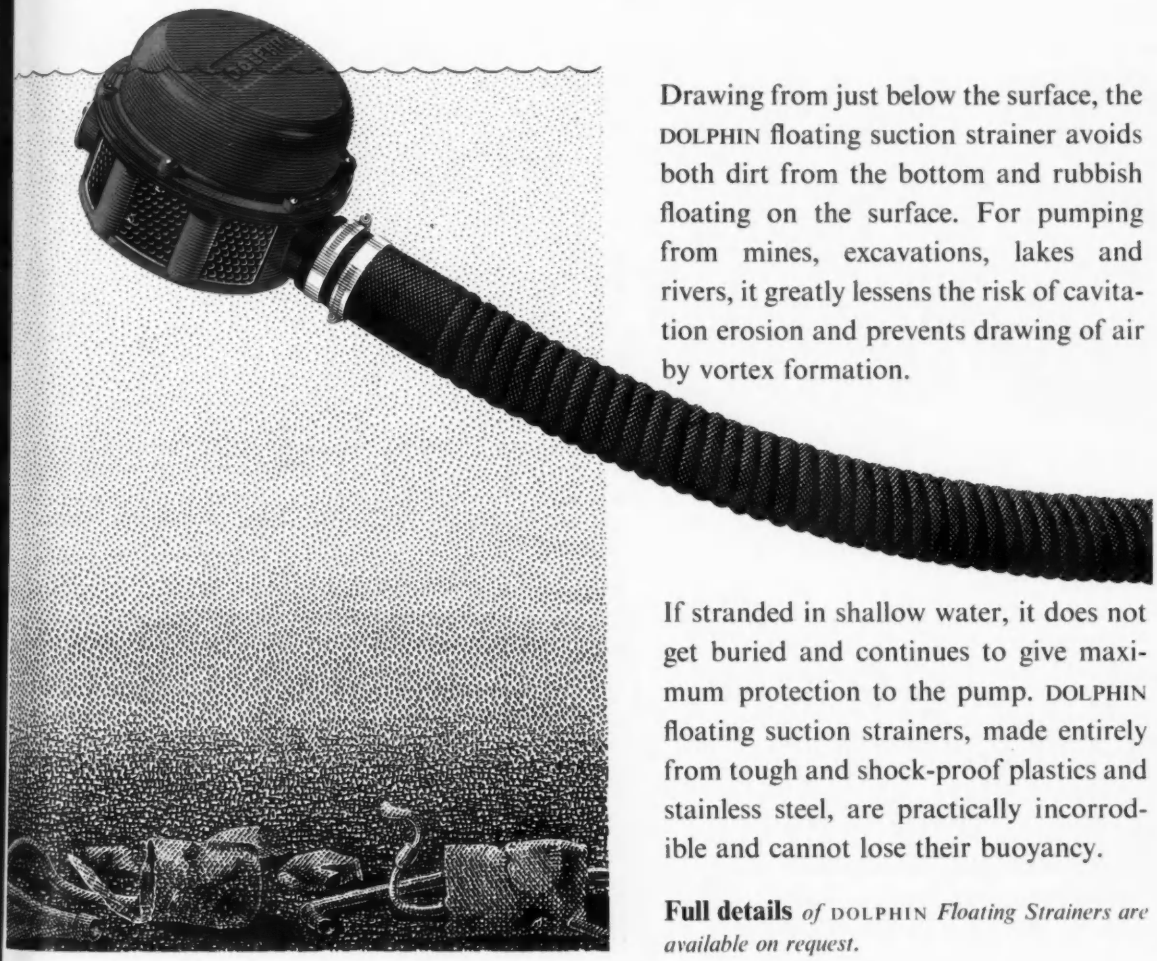

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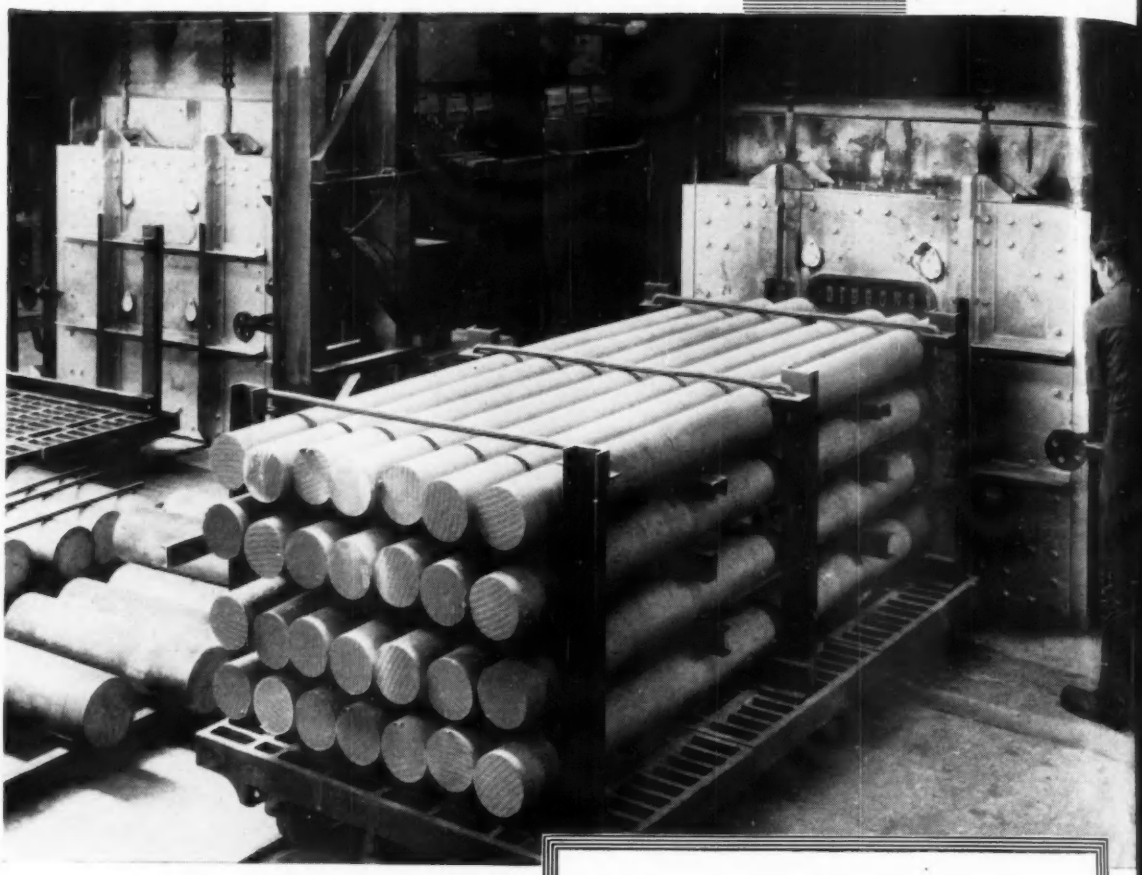

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GAS IN INDUSTRY

MAY 1959
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FEATURES

THE VITAL METAL DRUM. By Eric Ford

INDUSTRIAL GAS IN EAST ANGLIA. By R. F. Saggers

INDUSTRIAL CENTRE OPENS AT DERBY

HEAT TREATMENT IN SPRING MANUFACTURE

INDUSTRIAL RESTAURANT DESIGN. By 'Gastronome'

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*Editorial*

# Gas for Light Engineering

IT might be supposed that those gas undertakings outside the great industrial centres have not been able to share in the expansion in the use of gas by industry that has taken place since the war. This is by no means the case, as is shown by Mr. R. F. Saggers, Divisional Industrial Engineer of the Ipswich Division, Eastern Gas Board, in his paper the first part of which appears in our current issue. Though the industrial consumption of gas in this division may be lower than in other divisions of the Eastern Gas Board, it does represent 19.8% of all gas consumed as compared to 30.6% and 29% in the Tottenham and Watford Divisions respectively. If the number of industrial consumers of each of these divisions is compared, the consumption per head in the Ipswich Division works out higher than in the other two divisions.

Mr. Saggers describes the application of gas to the manufacture of agricultural and horticultural machines as well as fork lift trucks at the works of Ransomes, Sims & Jefferies Ltd. at Ipswich and it is noticeable that, wherever possible, full use seems to have been made of gas throughout the factory, though oil-firing in certain sections also seems to be practised.

Mr. Saggers' paper would suggest that certain heat treatment processes in the factory are being carried out by gas-firing because it had been found that this was in fact the best means available; and the conclusion to be drawn is that for some processes gas may have even replaced oil. The reference to Ferrogas is of very distinct interest since it would appear that by modifying coal gas by certain additives, there is a distinct advantage to be gained for metal cutting operations over the more usual propane or acetylene. Where Ferrogas is used, the cut is just as clean, but since the flame temperature is lower, there is less hardening on the surface of the metal, which is an advantage when the pieces cut have to go through a welding process later on.

This paper gives some idea how useful gas can be in the modern factory and the assistance it can be in the manufacture of light machinery away from centres of heavy industry. Such considerations are of great importance at a time when the tendency is for industry to be taken more and more into rural areas.

If gas can be laid on to newly-planned industrial estates, not only will the full advantage of a refined fuel on tap immediately become available but also the provisions of the Clean Air Act can be easily complied with and the amenities of the countryside preserved. Gas should be well able to hold its own with oil or electricity for such loads as these.

In this way, the most modern methods of heat process work can be applied to old-established industries such as the manufacture of agricultural machinery in areas where more conservative ideas are more likely to be found.

We were particularly interested to see the extent to which gas-fired space heating by a number of small units had been used and also the somewhat unusual use of gas for running-in lawnmower motors and M.G. tractor engines.

# THE VITAL METAL DRUM

## A leading manufacturer uses 72,000 therms a year. The processes involved are described by Eric Ford

METAL drums, kegs and containers of many different kinds are used in vast quantities in the modern world for the transport and storage of all types of liquids and other materials, ranging from petroleum products and paints to chemical powders and fertilisers. So vital is the need for adequate supplies of suitable containers of this kind that the manufacture of metal drums and allied products is now an industry in its own right.

### *Important stages*

One of the leading British firms in this field is London Containers & Noakes Ltd., of Beta Works, Butchers Road, London, E.16, from whose factory hundreds of thousands of metal drums are despatched annually to firms in all parts of the United Kingdom. Gas, supplied by the Eastern Division of the North Thames Gas Board, is employed at the rate of about 72,000 therms a year, being used in several important stages of the manufacturing process.

Two old-established firms, both with wide experience of the manufacture of metal drums and containers, joined forces in 1954 to make the present firm of London Containers & Noakes. B. Noakes & Co. Ltd. had already been engaged in this field for a century at the time of the amalgamation, while the London Keg & Drum Co. Ltd. had 50 years' experience behind them. It is thus clear that when the two firms came together at the extensive and well-equipped site in London's industrial East End, they were able to offer an enviable range of containers to the trade.

All stages of the manufacture of steel drums are carried on at the factory, where assembly line methods have been devised and applied to the particular processes involved. The basic raw material consists of sheet steel of various gauges, many thousands of tons of which are used annually. This steel is fabricated into drums and painted and it is in this latter process that gas-fired ovens are used to dry the painted drums. In addition, certain of the drums are tested in water tanks before painting, and these drums are dried in gas-fired ovens before passing to the painting stage.

There was a time when metal drums were commonly painted by hand in a rough-and-ready fashion, which was expensive in terms of paint and resulted in a product which, though serviceable, was unattractive to the eye. Since the war, the users of metal drums have demanded much better finishes, calling for up-to-date painting techniques and better quality paints. Paint stoving has thus become a matter of considerable importance and it is for this reason that the gas-fired ovens have assumed such a vital role in manufacturing process.

Since London Containers & Noakes supply metal drums to the trade, it will be obvious that they must at all times pay close attention to customers' requirements and the wide variety of products which can be seen coming off the production lines at any given time is, in itself, evidence of the success with which they have pursued this policy. To be able to meet the varied and changing needs of industry for metal drums and kegs presupposes considerable flexibility in production methods and techniques and this, indeed, is one of the first points noted by a visitor to the works.

*This bird's-eye view of the large Stordy oven gives an excellent idea of the two direct-fired heat exchangers, mounted on the roof, and the simplicity of the design.*

### *Mechanical handling*

There are several production lines in the main department of the factory and these have been laid out with the utmost economy of space and with full use of all appropriate mechanical handling arrangements. Mechanical handling plays an important part in the manufacturing process and every possible use is made of roller-conveyors, both powered and gravity. Of these production lines, one is capable of handling large metal drums of 40 to 45 gal. capacities while the others deal with smaller drums, with

diameters ranging from 5 in. to 14 in.

Both the layout of the production lines and the associated gas equipment has been designed to meet the different calls made upon them, although the basic fabrication procedure remains the same.

Consider, for example, the production line which is engaged on the manufacture of the large 40-gal. drums. The sheet steel is first sheared to the required size for the particular final product and almost simultaneously the heads and bottoms of the drums are automatically blanked out. Bungs of the type and number required for the particular order are also inserted.

## *Spot welded*

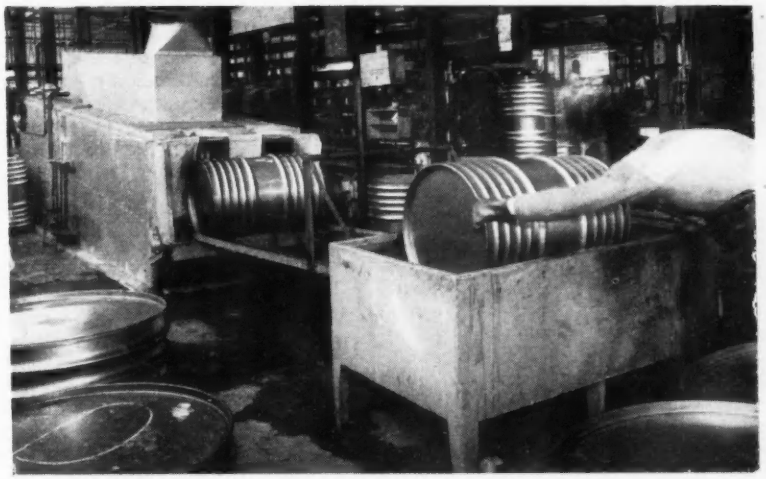
These steel body sheets, still in flat form, are now subjected to a grinding process along their edges to facilitate welding. The sheets are next rolled to shape before being first spot welded and later seam welded.

By this time, the embryo drum, still without its two ends, is ready for expanding and for the impression of beads or corrugations, as required by the design of the final product. Both these processes are automatic. The ends of the body are then flanged and it only remains for the tops and bottoms to be placed in position and seamed to the body, during which process a special sealing solution is inserted.

All the drums are then air-pressure tested in an open water tank by an operative who examines both the welded seam and the top and bottom for the bubbles which indicate a fault. Faulty drums are laid aside for further attention while those which pass the test move on to the painting stage, via a gas-fired oven which dries the drums after their immersion in the water tank.

This oven was originally acquired from a manufacturer but has been greatly modified by London Containers & Noakes Ltd. to meet the requirements of the drums passing through it for drying. It is a hot-air re-circulating oven, direct-fired with aerated bar burners and the drums move slowly through on a conveyor belt. An operating temperature of approximately 250°F. is generally adequate for the purpose, namely, to dry the drums sufficiently for painting.

Drums coming off this production line were of the type which have two rolling hoops round the body of the drum, giving three equal panels, which were being painted red and yellow, as required by the well-known petroleum company for whom the drums were being made. After spray-painting in a painting booth, the drums were automatically moved into an upright position by an ingenious device, designed and made by the company, and gently propelled on to a chain-driven conveyor belt and into a large Stordy oven, manufactured and installed by Stordy Engineering Ltd., Midland Chambers, Princess Street, Wolverhampton.



*Large metal drums of 40-gal. capacity are tested under air pressure for possible leaks in a water tank. They then pass automatically through the gas-fired oven in the background for drying before moving to the painting stage.*

This oven was constructed to meet the detailed requirements of London Containers & Noakes Ltd., who co-operated closely at all stages of the design and who acknowledge the assistance and valuable advice given by the local industrial representative of the Eastern Division of the North Thames Gas Board.

It is a tunnel oven, open at both ends, is 50 ft. long, 6 ft. 6 in. high and 8 ft. wide. It is heated by two direct-fired heat exchangers, mounted on the roof of the oven. The heat exchangers are under separate thermostatic control, the temperatures required being pre-determined by the operator. Various factors determine the operating temperatures and it is in this direction, of course, that the accumulated experience of the company's engineering staff enables the best use to be made of the equipment.

## *Heat exchanger*

Temperatures for paints in general use are likely to be in the 250°F.-300°F. range. The heat exchanger feeding the entry point of the oven normally has a higher gas rate than that feeding the exit, for the obvious reason that it is necessary to overcome the heat loss due to absorption by the metal containers on entry, in a cold state, into the oven.

A cold air seal is provided at each end of the oven, thus retaining the heat within the tunnel and obviating the necessity of oven doors which would, of course, render impossible the conveyor belt feed technique which is an essential part of the process. Cold air, produced by an electrically-operated blower incorporated in the equipment, is blown across both openings through narrow slits at each side. This device was one of the features of the oven which was introduced on the advice of the Gas Board.

## *Better control*

This Stordy oven was installed in August last year and the decision to do so was taken in consequence of problems associated with the curing of Epikote paints. Although normal paint curing can be carried out by infra-red tunnels, it was found in this instance that a curing time of ten minutes held at about 300°F., after being brought up to that temperature in the first two minutes, was necessary. With the thermostatic control arrangements and variable speed drive of the conveyor belt, the operating conditions can be varied by the company as required by the paint to be cured and the throughput of the work. Much better control of the process is possible with a convection oven as compared with an infra-red tunnel, and this is a particularly important factor in view of the growing importance of an attractive and effective finish to painted drums and other containers.

Tests were undertaken on this oven shortly after its installation last year and observations covered a seven weeks' period, during which a large number of drums were satisfactorily dried. Gas rates during this test period varied with the temperatures and loads going through the oven, but a typical test showed that a double line of drums going through the oven

resulted in a gas rate of 2,100 cu.ft. per hour, maintaining a temperature of 330°F.

Maximum gas rate of the Stordy oven when starting up from cold is 2,500 cu.ft. per hour. The oven is constructed to take a double line of drums and is fitted with full safety control equipment, including purging time, flame failure device, etc.

Although this particular oven has only been in operation at London Containers & Noakes Ltd. for the past eight months, it is clear that the company has already completely integrated it into their efficient production line. Since the equipment is fully automatic, it is unnecessary to have any personnel standing by in a supervisory capacity. The company states that it regards the operation of the oven as entirely satisfactory for the purposes for which it was designed.

On leaving the unloading end of the oven, the dried metal drums proceed on roller conveyors, partly under gravity, partly power driven, to the despatch bay.

## *Stoving oven*

Drums passing through the Stordy oven are the largest products of the company. At the other end of the production range and, indeed, at the other end of the factory, a gas stoving oven is used to dry the smaller open ended containers which the company produces.

Manufacturing procedures here are basically the same as in the case of the 40-gal. drums, an important difference, so far as the stoving problem is concerned, being the fact that these containers are painted both inside and out and have therefore to be dried both internally and externally. Because these containers are used for solids and powders it is, however, unnecessary to test them for possible leaks before proceeding to painting operations. Thus only one oven is required in this particular production line.

## *Watson House*

This is a re-circulating hot air drying oven with automatic conveyor, constructed in the form of a tunnel, open at both ends to permit unrestricted entry and exit of the containers for drying. It was designed and manufactured by the North Thames Gas Board industrial workshops at Watson House and the installation was carried out under the supervision of the Board's industrial representative for the area.

Watson House industrial gas engineers evolved the design of the oven in the light of the special requirements of the process, after trial tests at Watson House, using samples of the articles to be dried and the paints to be used. In order to facilitate erection on site and to minimise the time taken, the oven was made in two separate units.

A conveyor, complete with driving gear, belt and ancillary equipment, and mounted on its own stand, was first installed. The oven unit, also on its own stand, was then built over the conveyor, in sections.

Both the oven body and the heat exchanger body are built of 1-in. thick Marinite insulating panel, secured to angle framework. This board has proved extremely useful in the construction of ovens of this type as it is easily worked, has high insulating properties and is completely fireproof.

Sited on top of the oven the heat exchanger is supplied with air from a blower with a capacity of 1,000 cu.ft. per minute. Heat is supplied from a No. 600 Hypact burner.

Controls include a Thermoperl flame failure valve with thermocouple, a gas pressure governor, relay valve and Aric indicating thermostat. There is a fan failure valve inserted in the return duct, operated by air flow within the duct and this in turn shuts down the gas way in the relay valve when air ceases to flow. All controls are mounted on the roof of the oven.

Hot air enters the oven through the roof near the outlet end. It proceeds into a duct running the full length of the oven and is blown downwards, thus ensuring the internal as well as external drying of the painted drums. The recirculating duct is taken from the base of the inlet end of the oven and brought back to the fresh air inlet duct of the blower.

A cold air seal is provided at both ends of the oven to prevent the escape of hot air from the oven itself while permitting free movement of containers on the conveyor. For this purpose, a second blower is situated under the oven and ducted to each end of the oven to make a seal.

Fresh air inlet duct and bleed ducts are damper controlled and set under working conditions.

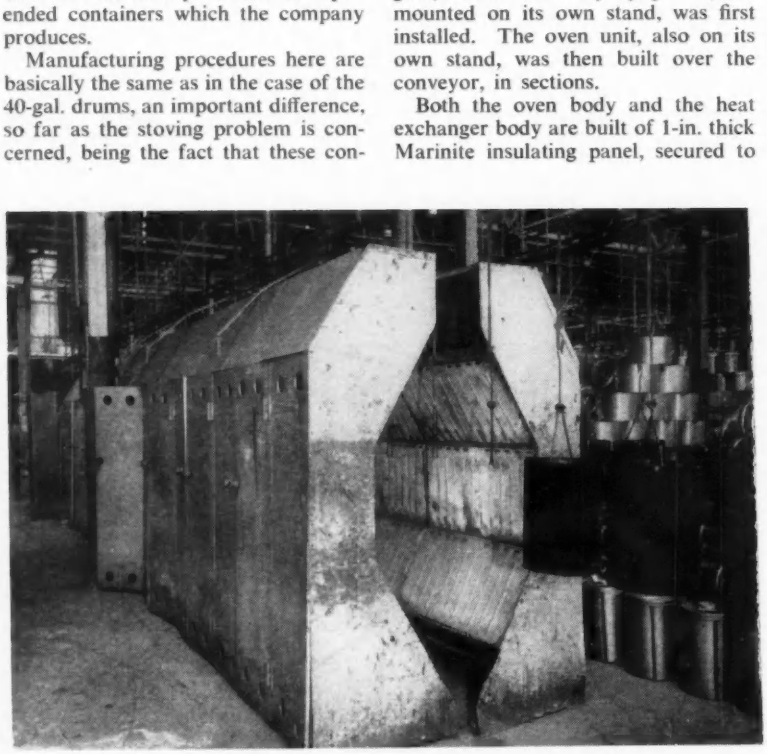
This oven is compact in design and well sited for the approach of incoming containers and their removal after drying.

The oven has an overall length of no more than 20 ft. and is 2 ft. 3 in. wide, plus 5 in. for the recirculating duct. It is 5 ft. 3 in. high to the top of the oven, with a further 2 ft. 3 in. to the top of the heat exchanger.

## *Conveyor belt*

Conveyor arrangements comprise a belt of interlocked wire travelling through the open on Tufnol strips at each side and returning on rollers, with variable speed drive and tensioning gear at the outlet end. This conveyor belt has a total length of 33 ft. comprising a 10-ft. entry section, 20 ft. within the oven and a 3-ft. exit.

In order to ascertain costs, a check meter was installed on the gas line supplying this oven and the consumption and throughput established over a considerable period. Maximum gas consumption is three therms an hour but in actual practice the overall operating consumption is approximately one-third of this figure.



*Travelling on an overhead system, these painted drums are stoved in a gas-fired infra-red oven at London Containers & Noakes Ltd.*

On reaching the end of the conveyor belt dried containers move to a gravity feed roller system for transmission to the despatch bay.

An examination of these two contrasted examples of the use of gas in the drying of metal drums indicates the approach which London Containers & Noakes Ltd. have made to the problem. Given the essential nature of the process, namely, the rapid and thorough drying of painted receptacles, it is then necessary to select the type of stoving oven best suited to the particular process.

### *Even drying*

Elsewhere in the works, for instance, drums are dried after water testing in Ballard hot air recirculating ovens with direct-firing aerated bar burners. Some of the drums are painted by the electro-static process and are then dried in infra red ovens. In this case, the containers to be dried move automatically through the infra red tunnels on overhead conveyors which slowly rotate the drums as they pass through. In this way, the heat reaches all the parts of the container which therefore are subjected to an even drying process and also dry more quickly.

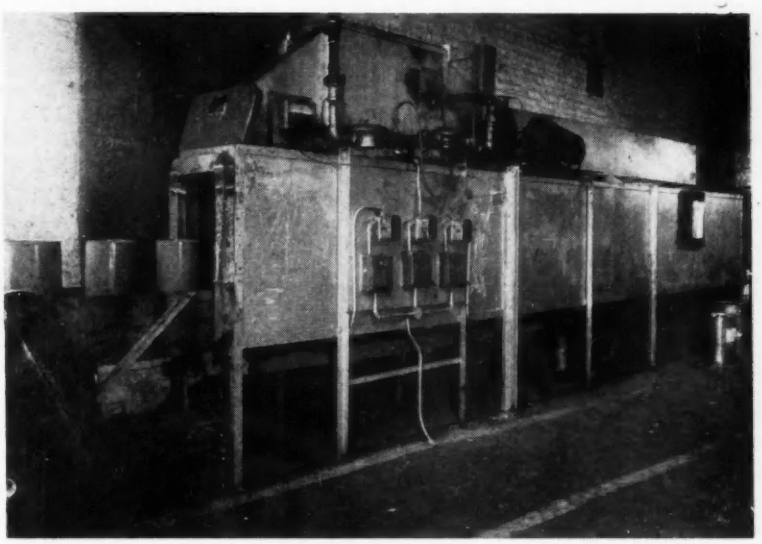
This process would not be practicable with the large drums which could not be turned in this way and hence the necessity for the greater heat possible in the case of the Stordy oven.

### *All-gas*

Other applications of gas at London Containers & Noakes Ltd. include a certain amount of gas soldering and a hot air recirculating oven used for drying latex, as required in one of the company's other processes. The company also has an all-gas works canteen and all offices are heated by gas, with a coke boiler for general factory heating.

Ovens for stoving operations of the nature required at the works of London Containers & Noakes Ltd. can seldom, if ever, be bought 'off the hook.' They require to be 'custom-built,' not only for the firm concerned, but for each particular process which the firm may require. Thus the efficiency of the gas-fired ovens at London Containers & Noakes Ltd. reflects credit both on the suppliers of the equipment and the users whose engineering staff, under the direction of the firm's joint Managing Directors, Mr. A. L. Brodie and Mr. Jack Noakes, collaborated in the design of the equipment, modified a great deal of it and have developed the most suitable operating procedures for the circumstances.

A third partner in a matter of this kind is the local gas supply authority, in this case, the Eastern Division of the North Thames Gas Board, whose responsible officer, Mr. L. Dunn, has at all times been available to ensure that the customer obtains the best possible service from the supply of industrial gas.



*Metal containers are dried both internally and externally in this re-circulating hot air oven with automatic conveyor. It was designed and manufactured by the North Thames Industrial Workshops, who also carried out the installation.*

## *Manufacturers loaned equipment to Scottish refresher course*

THE Scottish Gas Board recently held an industrial training and refresher course to brief all industrial staff on the latest technical developments. Mr. H. R. Hart, Board Member, officially opened the course and stressed the importance of the industrial gas load. The programme was drawn up by the Board's Area Industrial Gas Sales Officer, Mr. A. Higgs.

A comprehensive review of all types of gas burner equipment was afforded together with specific theoretical and practical examples of efficient and inefficient application to a variety of industrial applications. The selection and practical application of flame failure and all types of ancillary control devices was considered in detail.

Equipment was loaned by a large number of manufacturers, and lecturers from selected firms dealt in detail with the latest types of industrial gas-fired furnaces and ovens, enlarging on the salient features in design.

The Gas Council No. 2 Research Station, Solihull, made a substantial contribution with lectures on the design of explosion reliefs, flame traps, suction pyrometers and jet burners.

The subject of competition from other fuels and electrical energy was dealt with. Examples of loads secured by re-design of plant so as to derive the maximum advantages from town gas were given. The importance of always obtaining the highest utilisation efficiency by correct design, choice of materials and burner equipment and controls was emphasised and demonstrated.

A comprehensive range of working exhibits and practical demonstrations supported the lectures.

A visit was made to the Renfrew and Dumbarton works of Babcock & Wilcox Ltd. Guests at lunch included Mr. Franklin, Chief Engineer of Babcock & Wilcox, Mr. Gibb, plant engineer and Mr. Guy, engineering assistant; Mr. L. G. A. Leonard, Managing Director of Dowson & Mason Ltd.; Mr. A. Lowe, Director of Thermic Equipment & Engineering Ltd., and Mr. J. Fearn and Mr. McFarlane of the Incandescent Heat Co., Ltd. Mr. H. R. Hart, Divisional General Manager and Board Member, tendered the thanks of the Board to Babcock & Wilcox and to the furnace manufacturers who had co-operated so wholeheartedly in providing equipment and speakers for the course.

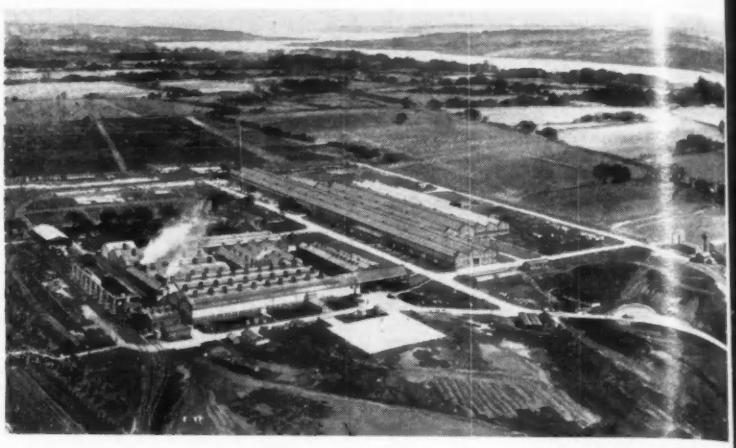
# Industrial gas in an East Anglian division

THE intention of this paper is to report the industrial activity of a division serving a large area acknowledged to be predominantly agricultural. It will perhaps be shown that what exists is mainly due to either geographical or historical causes. Because of the diversity of applications, and the absence of proper development and research facilities within the division the content is mainly confined to examples of individual installations. It is hoped that these will be of interest to industrial gas engineers working in similar areas.

East Anglia is commonly understood to be the area bounded by the North Sea, the Wash, the Great North Road and the River Thames, but to be historically correct the Anglo-Saxon kingdom of East Anglia consisted only of Norfolk and Suffolk. The Ipswich division of the Eastern Gas Board covers about half of this kingdom, and contains the major part of Suffolk and North East Essex, its four corners being the towns of Leiston, Haverhill, Chelmsford and Burnham-on-Crouch. The largest town is Ipswich with approximately 120,000 inhabitants, and the only other towns of any size are Chelmsford and Colchester, each with less than half this population. The other towns are much smaller, and all are separated by distances varying between ten and 20 miles. At vesting date each town had its own gasworks, many of which were in a bad state and uneconomical. The new East Anglian grid which runs diagonally across the division from Aldeburgh to Chelmsford is supplied only from the major efficient works at Ipswich, Colchester and Chelmsford, and supplies many of the other towns, whose works have been closed and converted into holder stations. A few works remain to be connected. The grid has resulted in a vast improvement in the quality and quantity of gas supplied to the greater part of the division, and has also supplied gas where not previously available.

Table 1 shows the sales of gas in 1957-58 for all divisions of the Eastern Gas Board,

Industrial gas sold by the Ipswich division increased by 63% between 1952 and 1958.



*An artists impression of the works of Ransomes, Sims & Jefferies Ltd., with the River Orwell in the background.*

## A WELL-ESTABLISHED MANUFACTURER OF AGRICULTURAL IMPLEMENTS

WHEN Robert Ransome came to Ipswich in 1789, he was obviously aware that the locality offered a good market for the agricultural implements in whose manufacture he specialised, and with a modest capital of £200 he set up a workshop. Incidentally, in 1817 he set up a gasworks and supplied gas lighting in the town, until 1822. As a result of his endeavours the business developed rapidly and there was a gradual move to the dockside where the Orwell works of Ransomes Sims & Jefferies Ltd., now cover 35 acres. The firm now employs a total of 3,050 people. The main products are confined to lawn mowers, agricultural implements, combine harvesters, fork lift and other electric trucks, tractors and crop driers.

### Recuperative furnace

Many of the component parts of these products are either cast, forged or fabricated from steel plate and sections. The forge department at Orwell works uses a large amount of fuel oil in a number of forging furnaces, but also burns large quantities of gas. One large piece of equipment is a Gibbons recuperative furnace used for heating a variety of steel shapes up to 1,000°C., prior to pressing. This furnace has internal dimensions of 9 ft. 6 in. by 5 ft. 6 in. by 1 ft. 6 in. to spring of arch, and consumes 3,600 cu.ft. per hour. It is normally operated under reducing conditions in order to reduce scale formation, which is one of the advantages of town gas furnaces.

### Further orders

An interesting application is a pair of thermic bar heating furnaces fired by concentrated combustion burners and capable of working at 1,350°C. These furnaces are mainly used for heating 3 in. by 1¼ in. steel bars in two places so that two bends can be made simultaneously, and are fitted on rails so that the distance between centres of bends can be varied at will. Three bars are accommodated at a time, and working on a 'one in-one out' basis an output of 24 workpieces per hour is achieved, the fuel cost being equivalent to that when oil fired furnaces were previously used. Resulting from the success of this application of c.c. burners, the firm have since placed orders for similar furnaces.

The forge department has several machines using Ferrogas for the flame cutting of steel plate. These machines cut several identical components at a time using profile guidance around a standard pattern. Ferrogas is a mixture of town gas and a proprietary additive based on ether,

TABLE 1

| | Tottenham | Watford | Cambridge | Ipswich | Norwich |
|---|---|---|---|---|---|
| Industrial sales. Therms. .. .. | 13,499,108 | 10,603,393 | 3,810,894 | 4,069,254 | 1,582,025 |
| Total sales. Therms. .. .. | 44,186,238 | 26,667,381 | 19,473,120 | 20,420,172 | 12,506,451 |
| Industrial sales/total sales .. | 30·6% | 29·0% | 17·7% | 19·8% | 12·7% |
| Number of industrial consumers .. | 1,957 | 1,093 | 283 | 358 | 593 |

compressed to 20 p.s.i. and distributed by pipeline to the cutting machines where oxygen is added at the burner heads. It is claimed that Ferrogas is considerably cheaper than oxy-acetylene or oxy-propane; provides a cleaner cut, the edges of which are not hardened and are suitable for welding, and provides better operating conditions because its flame is not hard to the human eye. For flame descaling of steel parts received from the oil fired furnaces, oxy-acetylene has recently been replaced by Ferrogas costing 5s. 3d. per hour, inclusive of town gas and oxygen, compared with 9s. 3d.

Next to the forge is a heat treatment department where five Brayshaw Lopress recuperative furnaces are used for general purpose heat treatment and pack carburising. Also installed in this department, are five double pot Kasenit cyanide salt baths and two other salt baths. The total maximum gas rate of the forge and metallurgical departments is of the order of 19,000 cu.ft. per hour when warming up each morning, settling down to an average of 9,000 to 10,000 cu.ft. per hour for the rest of the day.

The method of heat treatment of plough components is based on one of Robert Ransome's original patents and is still secret. It is carried out by a special department where the installation includes several Gibbons furnaces having rotary hearths 8 ft. 3 in. in diameter. These furnaces are automatically controlled to the critical standards of temperature required by the process. Each furnace has a maximum gas consumption of 1,800 cu.ft. per hour, and operates continuously throughout 24 hours a day at 1,200 cu.ft. per hour. The burners are the Eddy Ray type using low pressure gas mixed with air at 18 in. w.g.

Orwell works also includes the main offices, warehouses, raw materials store, rail sidings and dock facilities, and T and E departments. The former manufactures threshing machines, while the latter is responsible for electric traction and material handling machines. Both use fair quantities of gas in finishing processes.

## Quantities of gas

Another section of Orwell works makes lawn mowers of all varieties and sizes, from small hand machines to the large gang mowers. Large quantities of gas are used here by several pieces of equipment, the most important being a flow-coat enamelling plant installed by Stordy Engineering, Ltd. Assembled parts hung from a continuous conveyor first pass through a series of spray-bonderising, drying and preheating chambers. Tanks containing about 1,600 gal. each of the bonderising solution are heated to 140°F-160°F. in two hours by 5 in. diameter immersion tubes. Each tube is fired by a neat gas burner and discharges into a header tube finally leading to atmosphere. The temperature of each tank is automatically controlled by immersion thermostats and relay valves. The parts pass to a heated paint spraying chamber and from there to a stoving tunnel. The drying, preheating and stoving chambers are individually heated by recirculation of hot air from direct fired gas heaters. Each of these is fully equipped with protective equipment of the flame electrode pattern, and has automatic temperature control. The maximum gas rate of this installation is of the order of 9,000 cu.ft. per hour.

An interesting application is the testing of the engines of petrol driven lawn mowers and the running-in of the M.G. tractors by town gas burned in specially designed carburettors which are fitted in a few seconds to the air intake of the normal petrol carburettor. The use of town gas for running-in keeps petrol exhaust fumes out of the building, reduces the fire risk of petrol cans and is said to prevent initial cylinder wear, although producing slightly higher temperatures than petrol. The most important advantage is in economy, since for this application one therm of gas is approximately equivalent to one gallon of petrol. The total working load of the lawn mower works is of the order of 12,000 cu.ft. per hour.

## Discontinued process

The firm had first made malleable iron castings in 1867 but had discontinued the process some ten or 12 years later. In 1951 they decided to make malleable iron castings again because there were difficulties in obtaining them from outside suppliers. It was decided to make whiteheart with a tensile strength of 25 tons per sq. in. and elongation of 4-10% rather than blackheart. After a period of experimental work in 1952 during which annealing was carried out by contractors, a gas fired 'Top Hat' annealing furnace of five tons nominal capacity was erected. A steel casing lined with lightweight refractories forms the base and hood, and several luminous flame burners fire vertically upwards from the base, the hot gases falling and passing over calorised steel recuperator tubes, fitted below the hearth. The castings are placed into protective pots containing ore, the furnace accommodating three rows of six, three pots high. The net weight of castings is

*From a paper by*

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DIVISIONAL INDUSTRIAL GAS ENGINEER, IPSWICH DIVISION, EASTERN GAS BOARD,

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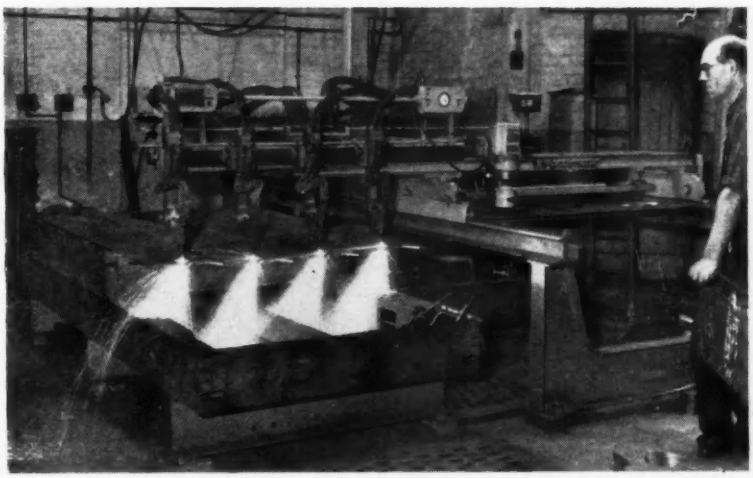
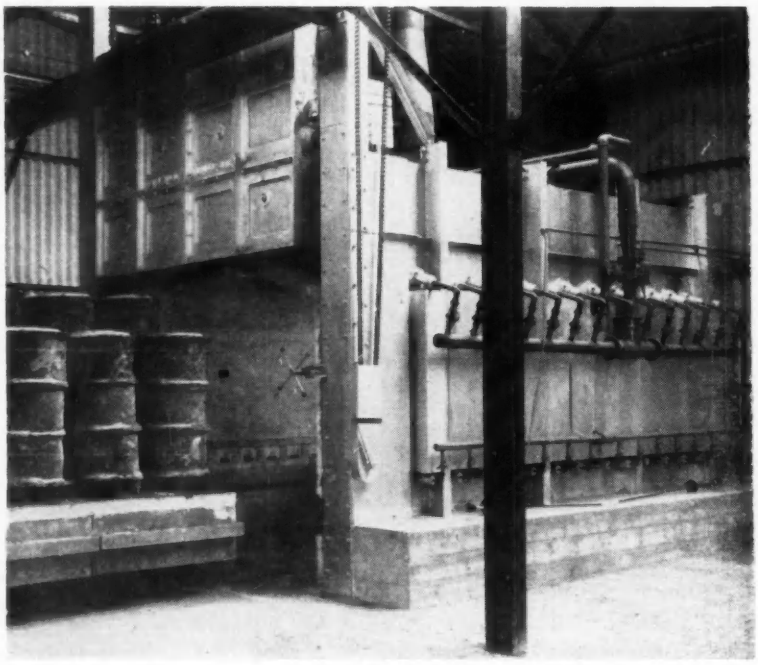


*The smith shop at Orwell works, featuring the Ferrogas machines.*



*The Dowson & Mason malleable annealing furnace foundry.*

five tons, the gross weight of castings, pots and ore being 18 tons.

The annealing cycle is as follows. Heating up in 30 hours to soaking temperature of 980°C., soaking for 80 hours at the same temperature, followed by cooling in 48 hours to 600°C. The furnace is then opened, and the load allowed to cool to handling temperature in ten hours.

## Outstripped demand

The demand for malleable castings soon outstripped the capacity of this furnace, and it was decided to instal an additional furnace of ten tons nominal capacity. Because of inadequate lifting capacity and head room, this has a bogie hearth, made of mild steel with a lightweight refractory lining, and firebricks for the hearth. There are 28 horizontal luminous flame gas burners disposed equally on either side, the pots being protected from flame contact by guard tiles which deflect the flames upwards and downwards. Calorised steel recuperator tubes are fitted in a chamber in the arch. The normal load consists of 112 pots containing ten tons net weight of castings, the gross load being 36 tons. The time cycle is similar to that of the Top Hat furnace, automatic temperature control being applied by electronic methods in both cases. Both of these installations have been reported previously, but typical results are given in Table 2 which enable a comparison to be made between them.

The lower fuel consumption achieved by the bogie hearth furnace is due to the lower ratio of internal wall area to load, and the better insulation which is permitted by its static structure.

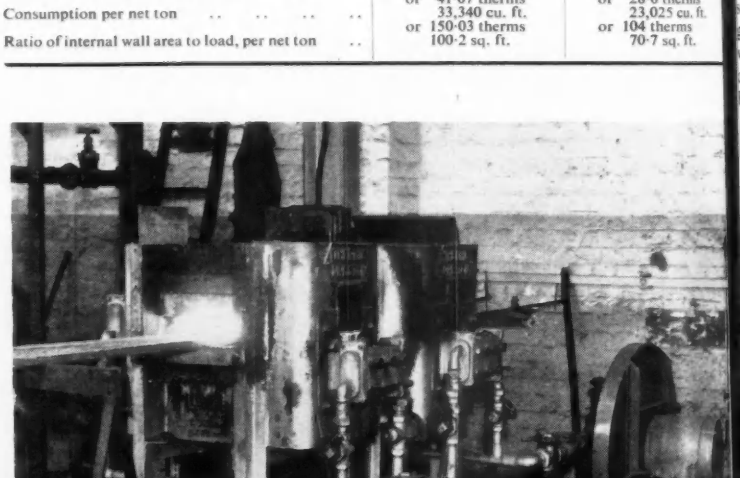
The plough works is the largest of the departments, the bays being 900 ft. long, without division walls, permitting in-line production. The completed ploughs and other implements pass bodily through two large gas-fired stoving tunnels. Combine harvesters and crop driers are also made by this department.

## Fuel savings

The company pays careful attention to working conditions and provides canteen facilities using gas fired catering equipment; washrooms with hot water from gas heated storage sets; and clothing racks heated by hot water pipes. The firm places great reliance on high temperature gas fired radiant heaters and the bays of the works are completely heated by Newtherm heaters thermostatically controlled by solenoid valves operated by electric thermostats. It has been

TABLE 2

| | Portable cover | Bogie Hearth |
|---|---|---|
| Nominal capacity net. .. .. .. .. | 5 tons | 10 tons |
| Gas consumption to reach 980°C. .. .. .. | 79,500 cu. ft. | 133,200 cu. ft. |
| Gas consumption to soak at 980°C. .. .. | 87,200 cu. ft. | 101,900 cu. ft. |
| Total consumption .. .. .. .. .. | 166,700 cu. ft. | 235,100 cu. ft. |
| Consumption per gross ton .. .. .. .. | 9,260 cu. ft. or 41·67 therms | 6,350 cu. ft. or 28·6 therms |
| Consumption per net ton .. .. .. .. | 33,340 cu. ft. or 150·03 therms | 23,025 cu. ft. or 104 therms |
| Ratio of internal wall area to load, per net ton .. | 100·2 sq. ft. | 70·7 sq. ft. |



*A Thermic bar heating furnace with c.c. burners. Note that the furnace is mounted on rails.*

found that this method of control has achieved fuel savings of at least 15%. The system has now been applied to the formerly uncontrolled space heating installations in the older buildings. It is estimated that Ransomes Sims & Jefferies, Ltd., have an installed total of 800 Newtherm heaters.

The combined annual gas consumption at both sites is of the order of 100,000 therms a year, taken through metering capacity of 155,000 cu.ft. per hour.

Some other medium sized firms also make agricultural equipment including R. Hunt & Co., Ltd., at Earls Colne; Richard Garrett Engineering Works, Ltd., E. R. & F. Turner Ltd., of Ipswich, Christy & Norris Ltd., of Chelmsford and E. H. Bentall & Co., Ltd., at Maldon. All of these use gas for manufacturing processes or for space heating, the last named having over 140 radiant heaters. Another well known company with over 300 heaters is Ransomes & Rapier Ltd., of Ipswich, who also use a fair amount of gas for heat treatment. Their products include concrete mixers, cranes, sluice gates and excavators.

The increased use of combine harvester has brought about a need for additional silo storage. This is because they deliver grain already threshed and often wet, which would cause rapid deterioration if stored for any length of time. Silos therefore have heating equipment for drying the grain when received and for subsequent re-drying if necessary. The gas heated silo at Halstead, Essex, was the first of its type in this country and was put into operation in December, 1950.

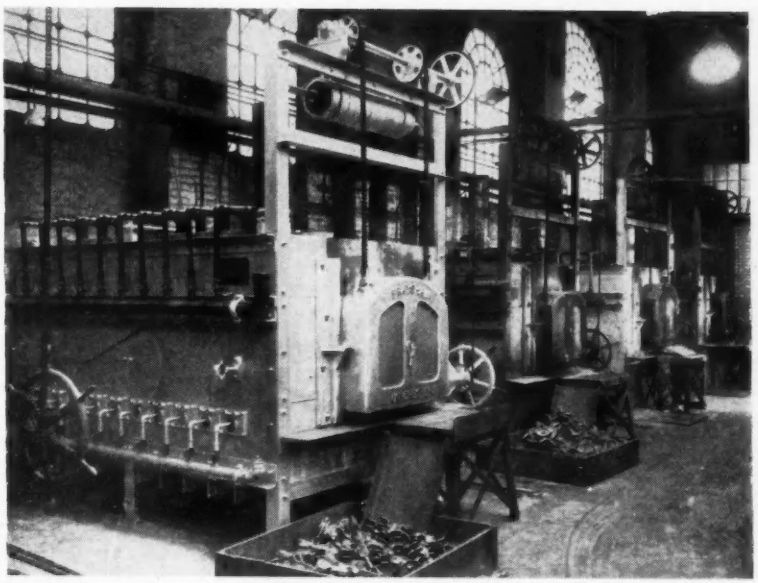
### Hot air fan

There are 22 storage bins with a total capacity of 750 tons, but only two are designed for drying. This is performed by warm air rising upwards through the grain and discharging to free atmosphere at the top of the building. The column of grain is 50 ft. high and a hot air fan is necessary to overcome its resistance. The warm air is generated in a Volex direct fired gas heater situated on the ground floor. Its temperature is controlled by a rod thermostat inserted in the duct connecting the fan with the storage bin, and operating a relay valve. Electrical means are provided to turn off the gas in the event of a failure of electricity to the fan motor.

A test was recently made during which 23 tons of wheat in one bin were dried from 20% moisture content down to 16%—the acceptable maximum for wheat storage. The process took 36 hours during which the operator changed the position of the grain in the bin on several occasions. Moisture tests and the temperatures indicated by thermometers permanently fitted at 10 ft., 25 ft. and 40 ft. above ground, informed him when this was necessary. This is the normal method of operation.

The heater was set at 144°F. and at a maximum of 600 cu.ft. per hour, using a total of 93 therms, equivalent to 1.0 therm per wet ton dried 1.0%. This is a high figure compared with more conventional grain driers and is accounted for by the monolithic concrete construction of the bin, which was cold after an idle period of several days. There is no doubt that the consumption would be very much reduced when the bins have been prewarmed and used continuously, but we have not had the opportunity of making tests under these conditions.

Full details concerning methods of drying grain and other crops are already available in literature published by the Gas Council.



*A Brayshaw recuperative furnace in the heat treatment department at the Orwell works.*

***To be continued***

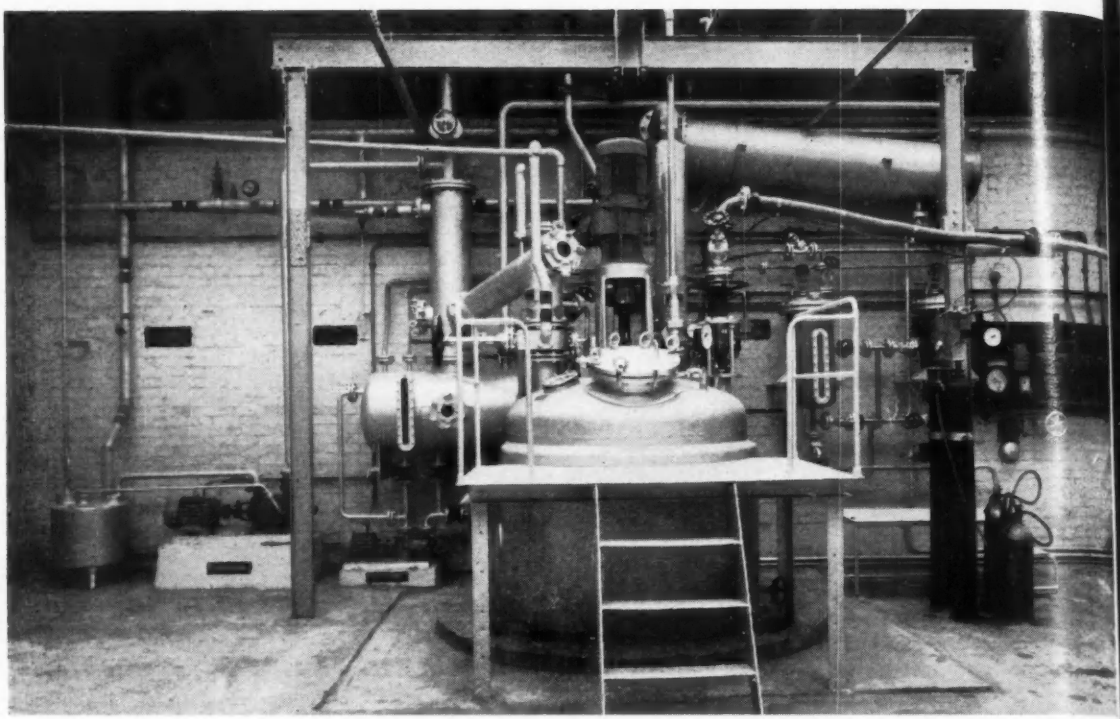
## NEW RANGE OF TRAY LOADING OVENS

*Barlow-Whitney gas-fired industrial oven with a choice of direct or indirect firing, and either vertical or horizontal forced circulation, or natural convection.*

A NEW comprehensive range of Barlow-Whitney gas-fired tray loading industrial ovens with a choice of either vertical or horizontal forced air circulation or natural convection, and of direct or indirect firing, has been introduced by Barlow-Whitney Ltd., of London and Bletchley.

Standard sizes range from eight to 72 cu. ft. capacity. Automatic temperature control is a standard feature and this, together with the low heat-loss factor, resulting from rigid double-skin construction and generous insulation, ensures high operating efficiency for the many heating processes for which tray loading ovens are necessary, including baking, curing, drying, pre-heating, stoving, and vulcanising.

Full particulars can be obtained from the makers Barlow-Whitney Ltd., 2, Dorset Square, London, N.W.1. (Telephone Ambassador 5485/6.)



*Front view of Sommer Schmidding Universal synthetic resin plant having a capacity of 3,000 litre (660 Imp. gal.). On the left is the sludge tank with spraying tower and the vacuum and sludge pumps. To the right is the water cooled condenser, twin solvent catch-pots, discharge pipe-line and the control panel.*

# Plant for handling synthetic paint resins

RECENT technical improvements in the paint manufacturing industry have created a need for plant to produce, in bulk, constituent materials of a consistently high quality.

Equipment of this nature gives other advantages, not so readily seen, over some of the previous methods employed. Economy in heat utilisation has been achieved over methods using a large number of individually heated small vessels. Handling and conveying the product have been simplified, since it can be pumped through pipe-lines to the respective storage tanks for use as and when required.

Such plant has been installed as part of their modernisation programme at Sherwoods Paints Ltd. of Barking, Essex.

The main vessel and the ancillary equipment were designed and constructed by Heinrick C. Sommer, Naclif, Dusseldorf, Germany.

The vessel is of stainless steel with approximate dimensions 6 ft. 9 in. high by 5 ft. diameter having a nominal capacity of 3,000 litre (660 Imp. gal.), and will hold a charge of approximately 2¾ tons. It is mounted at floor level in a refractory setting constructed by the M.E.T. Furnace Company of Trafalgar Road, Greenwich.

An agitator and foam breaker are fixed to a common spindle driven by an electric motor sited above the pot giving a choice of 33 or 67 revolutions of the spindle per minute.

*View of the burner pit showing the special air/gas proportioning valves, air blowing fan and the twin flues. The combined pressure governor and safety cut-off valve, with its connection to the 3 in. air line from the fan, is immediately behind the furthermost flue.*

The burner controls, air blowing fan and twin flues from the refractory setting are all situated in a pit outside the building housing the main plant.

Three specially designed air/gas proportioning valves are connected to 3 in. gas and air lines and serve the air blast burners of German design. These have a maximum combined gas rate of 2,400 cu.ft. per hour and fire beneath diffusing plates, the purpose of which is to prevent direct flame impingement on to the base of the pot. Included in the gas supply are a rotary meter, non-return valve, and a combined pressure governor and safety cut-off valve which opens only when the air supply is on.

A motor driven blower capable of delivering 175 cu.ft. per minute of air at 22 in. w.g. when running at 2,890 r.p.m. is fitted in the pit adjacent to the burner controls.

The installation of the equipment and gas supplies was carried out in conjunction with the Industrial Section of the North Thames Gas Board.

# INDUSTRIAL DEMAND MOUNTS IN EAST MIDLANDS: BOARD EXTENDS ITS ADVISORY SERVICE

BECAUSE of the increasing use of gas by industry in the southern part of the East Midlands Gas Board's area, covering Derbyshire, Nottinghamshire, Leicestershire and Northamptonshire, the Board has extended its technical advisory service to industry by opening a fully-equipped industrial development centre at the Board's premises in Friar Gate, Derby.

The opening ceremony was attended by many leading Midlands industrialists, and also present were Sir Harold Smith, Chairman of the Gas Council and Mr. R. S. Johnson, Chairman of the East Midlands Gas Board.

The centre is designed to give industrialists the widest possible service on all aspects concerning the industrial application of gas. It is considered to be a basic essential of the Board's service to the many varied industries in the four counties.

The development centre is in two parts—a comprehensive industrial showroom and an experimental workshop. The wide range of industrial gas-fired plant which is on display in the demonstration section includes examples of the most advanced heating plant and automatic control equipment. All of these are full-sized units working under typical factory conditions.

### Top-Hat furnace

One of the largest exhibits is the newly designed Top-Hat furnace consisting of a stationary base and removable cover which was designed principally for the ceramic industry where it is already arousing considerable interest. It can be also used in the steel industry for such processes as annealing malleable iron.

A wide selection of the latest gas burner systems is shown in operation many of which have been specially designed to simplify the conversion of factory equipment to meet the requirements of the Clean Air Act. It is intended to put all of this equipment at the disposal of consumers who wish to have specific tests carried out on their own particular products.

The technical staff demonstrates and advises upon all aspects of the industrial gas applications displayed in the centre, the related research and any other associated current developments.

The second section of the centre, the development workshop, undertakes experimental work upon the design and construction of prototype plant for industrial consumers who are considering expansion with modern machinery. The technical staff are available to devote full time study to these particular matters in discussion with consumers' own representatives and can recommend with detailed drawings and reports the most suitable installations to satisfy the particular consumer's requirements.

Coupled with this the facilities of the workshop are also used to conduct experiments based on testing consumer's plant in their own premises; the aim here is to solve consumer's fuel problems by suggesting plant modifications to maintain or improve efficiencies.

# *Scottish Central opens up new department*

A NEW department to advise industrial consumers has been set up by the Central Division of the Scottish Gas Board. In charge of the new department, with headquarters at the Board's offices at Friarton, Perth, is Mr. David Murray, aged 38, former assistant service and sales manager at Dundee. Representatives have been appointed as follows: Arbroath group, at Dundee, Mr. A. Knight; Kirkcaldy and Leven groups, at Kirkcaldy, Mr. F. German; Dunfermline, Stirling and Alloa groups, at Dunfermline, Mr. J. G. Douglas.

Mr. German, who has been with the Scottish Gas Board for ten years, was formerly with the Gas Light and Coke Company and Croydon Gas Company. He has been a gas fitting instructor at the Lauder Technical College, Dunfermline, and district representative with the Fife group.

*Pictured here at the opening of the East Midlands Gas Board's new industrial development centre, at Derby, are, on the left, Mr. K. L. Pearce, General Manager of the Board's Notts and Derby division, with Mr. R. S. Johnson, Chairman of the Board; and on the right Sir Harold Smith, Chairman of the Gas Council, and Mr. William Brown, joint Managing Director of the Chesterfield Tube Co. Ltd.*

## *INCANDESCENT HEATING FORMS DIVISION*

FOR some years, the Incandescent Heat Co. Ltd. have manufactured process equipment to the designs of the Swenson Evaporator Company (a division of the Whiting Corporation) of Harvey, Illinois. An agreement has now been reached by which Incandescent have exclusive selling and manufacturing rights in the United Kingdom for all Swenson products.

To handle this work, a chemical plant division has been formed, headed by Mr. C. J. V. Denning. In addition to dealing with all enquiries for Swenson evaporators, crystallisers, filters and spray driers, the division will handle other specialised equipment.

# Heat treatment for precision-made springs has fully-automatic temperature control

TOWN gas is widely used in the manufacture of the springs that, in their infinite variety, are key components in industry and transport, to mention only two applications.

In many instances the safety of operatives, or passengers, and machinery involving a high capital outlay, depends on the reliability of such components. The need for precision heat treatment will, therefore, be apparent and this need for a high quality, consistent and reliable product accounts for the wide use of town gas.

Gas-fired plant for the heat treatment operations connected with the manufacture of coiled springs has recently been installed at the premises of Cockburns (Springs) Ltd., Glasgow, a subsidiary of Cockburns Ltd., the world-renowned valve manufacturers.

Four main heating operations are carried out on the spring coils. They are as follows:

(1) Heating the material prior to coiling.
(2) Reheating for tapering and 'putting down.'
(3) Heating the coils prior to quenching for hardening.
(4) For tempering the springs after hardening to give reliability in service.

The initial process is the heating of the appropriate size of steel to a temperature of about 1,100/1,150°C. prior to coiling the springs. For this purpose two Dowson & Mason furnaces have been employed, the longest being 14 ft. 6 in. long by 2 ft. broad by 1 ft. high and the other 5 ft. 6 in. long by 5 ft. broad by 4 ft. 6 in. high. Both furnaces use air blast burner equipment, air being supplied from fans at 21 in. water gauge, while the burner system is arranged to fire under the arch so that there is no possibility of flame impact on the metal. The temperature is automatically controlled on both furnaces by means of Electroflo temperature-indicating controllers which operate in conjunction with motorised valves in the gas and air supply lines. The controls are set to maintain an almost neutral atmosphere within the furnace chamber. Both furnaces operate at temperatures of between 1,100/1,150°C.

For various forming operations two Dowson & Mason black-smiths' hearths are used. These are fitted with seven air blast burners arranged to direct the flame towards the centre of the hearth which is filled with Aloxite chips which provide the incandescent bed. The work, after heating to the required temperature, is either hand-formed or dealt with by a Massey motorised power hammer.

For hardening and tempering of the springs two Dowson & Mason furnaces are employed, again direct-fired by means of four air blast burners which are set so as to maintain an almost neutral atmosphere. The hardening furnace designed for a maximum temperature of 1,400°C. is 5 ft. 6 in. long by 4 ft. broad by 2 ft. high, while the tempering furnace has a maximum temperature characteristic of 200°C. and overall dimensions 5 ft. 6 in. by 4 ft. by 2 ft. 6 in. The gas rate of each of the latter two furnaces is 1,400 cu.ft. per hour and the springs are removed individually from such furnace before being quenched in oil. The tempering furnace is fired by means of six 1½-in. Amal injectors arranged three on each side and firing under the hearth and behind a baffle wall on each side of the furnace. This method is used for the tempering of the larger components, and again temperatures vary according to the type of steel, but can be as high as 800°C.

For the accurate tempering of smaller springs a gas-fired lead bath is employed and this is heated to temperatures up to 700°C. by means of Amal injectors. The bath's overall size is approximately 3 ft. 6 in. by 1 ft. by 1 ft.

It is interesting to note that the loading of the main furnace is such that 12 springs of sizes ranging from ⅜-in. to 1¼-in. section can be prepared for coiling by 15-20 minutes' immersion in the relevent furnace.

The products of Cockburns (Springs) Ltd., are approved by the Admiralty, Ministry of Transport, Lloyds Register of Shipping and the specifications laid down demand a very high degree of accuracy. The range of products vary from components weighing ⅛ oz. up to 90 lb. The largest spring which has, up till now, been produced in this works is of 8-in. internal diameter, 32 in. high and formed from 1¼-in. square section material. Every coiled spring is individually and thoroughly tested to withstand the specified load without distortion, and to guarantee this a special Dennison testing machine was installed in the factory. This testing machine is capable of imposed loads of up to 50 tons.

The annual consumption of gas by this company, is estimated to be of the order of 36,000 therms, which is related to a production figure of about £30,000.

*A Dowson & Mason black-smith's hearth at the premises of Cockburns (Springs) Ltd., with, in the background, a Dowson & Mason furnace.*

# INDUSTRIAL RESTAURANT DESIGN

## *Liaison is essential, says 'Gastronome'*

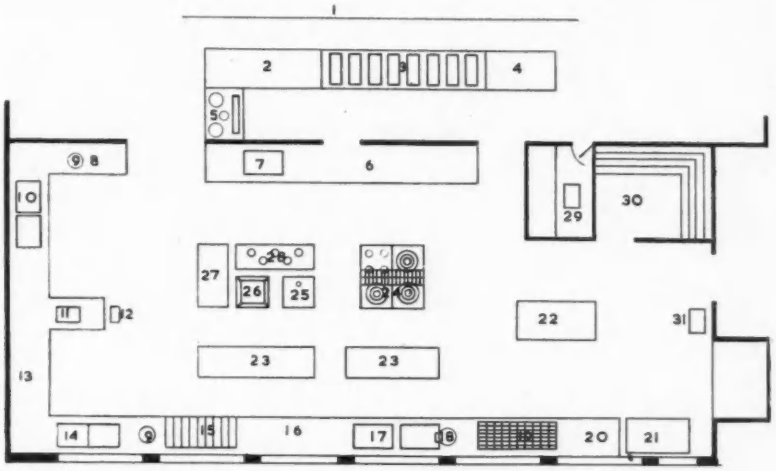
HOW are the kitchens of the factory and works canteens arranged; who designs the layout of the equipment and appliances; who decides upon the kitchen furniture; and who are the powers behind the numerous kitchens up and down the country? It is well to enquire this because it is very important to the gas industry. We are not so concerned over the gas load, which holds itself on its well-known merits, but we must concern ourselves that equipment installed is first class and of the correct specifications. Who then does influence those layout designs?

Perhaps the majority of designs are influenced by manufacturers of cooking and food service equipment. Many are designed by factors of catering equipment who also supply fittings and furniture. The larger installations will be the works of specialist architects, building organisations or consulting catering specialists. We in the gas industry can offer such a service and I suggest that we must if we are to consolidate the demand for our fuel and ensure that it is used efficiently and economically. It is essential that we have the closest possible liaison with all the other people who design either for the purpose of selling their products or who act as consultants only.

How do we go about this important task? No doubt the various gas boards have excellent liaison with architects and building contractors to keep them right up to date with the development of gas equipment, particularly with specialist appliances.

### Reward

With the data of development and production, catering equipment used in industrial restaurant kitchens should be included and promoted. Any assistance that is asked for by the architect should be readily given. It is essential that we in the gas industry should make ourselves competent in advising on equipment specification and design layout, so that our services may be of value to the architect. Our reward will be the gas load for many a year to come—a load that is one of the best available.




*Plan of a re-designed industrial kitchen.*

1. Service guide rail
2. Cold service
3. Hot service
4. Cold service
5. Cafe set
6. Preparation and service bench
7. Grill
8. Stacking table
9. Waste disposal units
10. Dish washing unit
11. Cutlery sink
12. Hand basin
13. Receiving table
14. Pot sinks
15. Pot rack
16. Preparation bench
17. Vegetable sinks and general
18. Potato machine
19. Vegetable racks
20. Bench
21. Refrigerator
22. General table
23. Preparation tables
24. Oven ranges
25. Steamer
26. Fryer
27. Bain Marie
28. Boiling table
29. Office
30. Dry stores

Manufacturers are to the fore in these design layouts, and naturally specify equipment of their own production wherever possible. A sound liaison is required in this instance.

We may find ourselves in a position of having to offer a layout ourselves, and a united effort by the manufacturer and the gas industry can do a lot to make design and installation a worth while project to both.

It may be that a competitive fuel is advocated, so the direct approach to the industrialist is called for. How do we tackle the matter? Here is a case that materialised a few months ago and may be of help to both industrialist and gas engineer alike, when dealing with the problem of re-equipping and re-designing the staff kitchens.

The job was to re-organise the canteen and kitchen and it was given to the catering manager to do. He approached several kitchen planning specialists who were able to furnish him with excellent layouts of varying design. It was at this stage that the catering manager visited the Hotel and Catering Exhibition at Olympia, London, and suffered rather extensively with mental indigestion caused, I assume, by seeing so many cooking appliances, power machines and allied equipment.

I met him on the stand of a manufacturer of stainless steel sinks; we were introduced and soon we found that his company were consumers in our Board's area. The discussion obviously turned to the matter most important to the catering manager, that of re-designing his kitchen. He knew what he wanted, but was hopeless at design. In short, he was typical of the caterer today, a specialist in his own way. It was agreed to let the gas board offer a design for consideration. I must admit that he was sceptical because he had never heard of a gas board designing a large scale kitchen. Domestic size, yes, but not a large scale one.

He told me that the greatest number of diners would be 200, with 180 usually, but a slight excess on occasion. There was the usual morning tea break, lunch and afternoon tea break. Kitchen and dining room staff

numbered ten in all. The area of the kitchen could not be enlarged upon. The choice of main courses at meals was in the order of four—three hot dishes and one cold dish.

**Final layout**

Here is how I set about it. I visited the proposed site of the kitchen. It was rectangular in shape and quite usual. It measured 45 ft. by 20 ft. with the dining room adjacent at the broad side. Each end was served by stairways and the factory goods lift at one end. The kitchen was on the second floor, which was, incidentally, the top floor. The installation of a main central range and ancillary cooking equipment offered itself as a basis of design with preparation area and washing areas to the walls with natural light most of the time.

This was the final layout. It had to be revised three times before it was acceptable on all points, quite a modest number of revisions by general standards. Here is the detail:—

*Stores:* Dry goods stores in which a section was given to cleaning materials. The storage racks were set 15 in. apart from floor to ceiling, with a depth of 2 ft. for the first two and reducing by 3 in. each shelf. Square storage bins on wheels completed this store. The cold store was a 30 cu.ft. capacity reach-in refrigerator, adequate where perishable food can be delivered daily.

*Preparation:* All benches were for general use; special use, such as pastry, was not considered necessary. Two sinks were specified for vegetable preparation, one sink for general preparation use.

*Cooking:* The equipment in the cooking area was made up in two banks in a central position. A solid top plate range was the hub of all the work, supported by a steaming oven, a deep fat fryer and boiling table for accommodating large cooking pots of potatoes and green vegetables.

**Capacity**

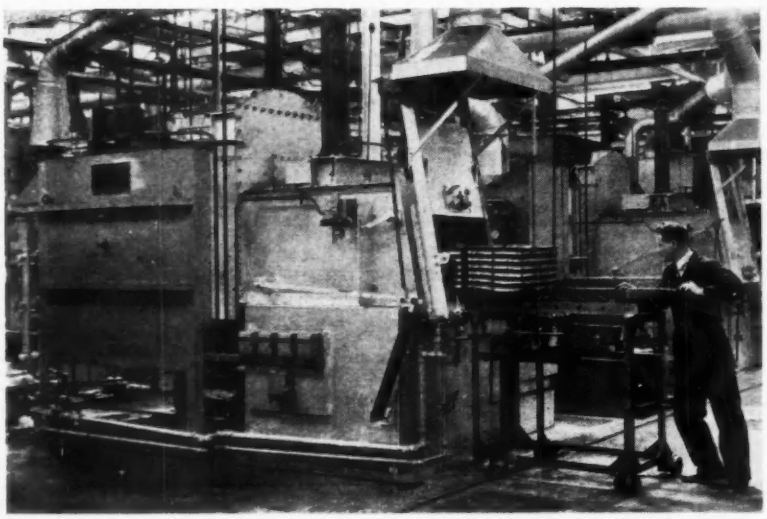
The range had three units fitted with solid hotplates. The fourth unit comprised a hotplate with open boiling burners, useful for initial boiling at the beginning of the day and at the end, also for fast individual cooking. It was considered that the four ovens were adequate in capacity to cook for the 200 people. The single steaming oven had a capacity of 6 cu.ft. and as such was capable of steaming 200 portions of puddings. The deep fat fryer was of the modern small unit design with cool zone. This type of fryer had a potential output of 100 portions of fried potato chips cooked in well under an hour. The boiling table had a short legged stand so that the cooking top was 21 in. above the floor level. This was specified so that pots of up to 10 gal. capacity could be used and moved about over the table surface with reasonable ease. The grill or salamander was situated adjacent to the serving hatchway connection to allow 'up to the minute' grilling and serving.

*Service:* This was simple in design, a boundary between the kitchen and dining room—surely the ideal position. It consisted of a cold section followed by two hot cupboards fitted with bain marie containers. This in turn was followed by another cold section for the service of sweets and finally a boiling water and beverage set.

*Washing-up:* The layout allowed the washing-up area to be placed adjacent to the dining room, giving a short return of clean crockery to the service area. An agitated water dish washing machine with two tanks, one for washing and the other for rinsing, carried the bulk of the washing-up work, an additional sink being installed for washing cutlery and covers.

The annual gas consumption was estimated at 2,500 therms, worth having and quite good value to the industrialist, as it represents 5,000 B.t.u. per meal plus three beverages, something in the order of less than £1 per day for fuel.


**THE VERSATILE "ALCASE" FURNACE**



***Processes—***

With an operating temperature range of 1,400° to 1,750°F., the following controlled atmosphere processes can be carried out.

1. Gas Carburizing.
2. Hot Oil or Marquenching.
3. Clean Hardening.
4. Dry Cyaniding or Carbonitriding.
5. Carbon Restoration.
6. Homogeneous Carburizing.
7. Clean Annealing.

***The two "Allcase" furnaces***

illustrated are at the works of a leading motor manufacturer, and are used for carburizing and carbonitriding steering and other parts requiring various case compositions and depths. The hearth area of each furnace is 3' 0" X 2' 0" with 1' 6" permissible depth of charge, and is designed to accommodate gross charge weights varying from 900 lbs. at 750°C. to 500 lbs. at 950°C.

***British Furnaces Limited · Chesterfield***

ASSOCIATED WITH SURFACE COMBUSTION CORPORATION, TOLEDO, U.S.A.

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